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Contemporary Management of Median Arcuate Ligament Syndrome Provides Early Symptom Improvement†

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Objectives: Optimal diagnosis and management of median arcuate ligament syndrome (MALS) remains unclear in contemporary practice. The advent and evolution of laparoscopic and endovascular techniques has redirected management toward a less invasive therapeutic algorithm. This study examined our contemporary outcomes of patients treated for MALS.

Methods: All patients treated for MALS at Dartmouth-Hitchcock Medical Center from 2000 to 2013 were retrospectively reviewed. Demographics and comorbidities were recorded. Freedom from symptoms and from reintervention were the primary end points. Functional quality of life was assessed. Follow-up via clinic visits and telephone allowed quantitative comparisons among patients.

Results: During the study interval, 21 patients (24% male), mean age, 37 years, were treated for MALS. All patients complained of abdominal pain in the presence of a celiac stenosis, 17 (81%) reported weight loss at the time of presentation, and 57% had a concomitant psychiatric history. Diagnostic imaging most commonly used included duplex ultrasound (81%), computed tomography angiography (66%), angiography (57%), and magnetic resonance angiography (5%). All patients underwent initial laparoscopic MAL release. Seven patients (33%) underwent subsequent celiac stent placement, in the setting of recurrent or unresolved symptoms with persistent celiac stenosis, at a mean interval of 49 days. Two patients required surgical bypass after an endovascular intervention failed. At 6 months, freedom from symptoms was 73% and freedom from reintervention was 64%. Eighteen (81%) patients reported early symptom improvement and weight gain, and 66% were able to return to work.

Conclusions: A multidisciplinary treatment approach using initial laparoscopic release and subsequent stent placement and bypass surgery provides symptom improvement in most patients treated for MALS. The potential placebo effect, however, remains uncertain. A significant minority of patients will require reintervention, justifying longitudinal surveillance and better patient selection. Patients can anticipate functional recovery, weight gain, and return to work with treatment.

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Significant Long-Term Predictors of Reintervention Following Percutaneous Subclavian Artery Revascularization◇

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Objectives: This study was conducted to determine long-term predictors of reintervention after percutaneous subclavian artery revascularization (PSAR).

Methods: This was a single-center retrospective review of patients with a symptomatic subclavian artery who underwent PSAR between January 1999 and December 2013. In-stent restenosis (ISR) was defined as stenosis ≥70% on duplex ultrasound and target vessel reintervention (TVR) as the occurrence of a repeat intervention. Freedom from events (ISR and TVR) was analyzed using Kaplan-Meier Curves. Cox regression analysis was used to determine the significant predictors of TVR and restenosis.

Results: Of the 147 endovascular revascularization attempts, 145 were successful (98.6%). A total of 118 patients (76.3% female) received initial subclavian interventions, and 19 (16.1%) required a secondary intervention (at least one TVR), whereas eight required more than one reintervention during the study period. Maximum follow up was 14.5 with a mean ± standard error of the mean of 7.3 ± 4.1 years. Patients were average age of 64.1 years. Comorbidities included chronic hypertension (69.5%), diabetes (38.1%), peripheral vascular disease (25.4%), and tobacco use (50.8%). Freedom from ISR and TVR at 1, 5, and 10 years was 93%, 83%, and 75%, and 94%, 87%, and 81%, respectively. Smoking increased the likelihood of ISR (hazard ratio [HR], 5.3; 95% confidence interval [CI], 1.7-17.1; $P = .004$), whereas the side of the intervention (right side) and increased age at the time of the intervention (by decade) decreased the likelihood of ISR (HR, 0.18; 95% CI, 0.03-0.83; $P = .028$) and (HR, 0.50; 95% CI, 0.32-0.77; $P = .002$), respectively. In the meantime, we found that smoking increased the likelihood of TVR (HR, 3.1; 95% CI, 1.01-9.6; $P = .048$), and that age (by decade) decreased the likelihood of TVR (HR, 0.511 95% CI, 0.32-0.82; $P = .006$).

Conclusions: Percutaneous subclavian artery revascularizations are feasible and durable, with satisfactory outcomes well beyond 10 years. Secondary interventions are common in smokers. Older age at onset and right side disease were found to decrease the odds of ISR and TVR.

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Risk Stratified Analysis of Open Versus Fenestrated Repair of Complex Abdominal Aortic Aneurysms†

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Objectives: Commercial availability of fenestrated stent grafts for endovascular aneurysm repair (FEVAR) in the United States has expanded options for patients with complex (juxtarenal or suprarenal) abdominal aortic aneurysms (CAAA). This study evaluated outcomes of open vs FEVAR repair of CAAA using the National Surgical Quality Improvement Project (NSQIP) database.

Methods: The NSQIP Participant Use File (2012) was queried by Current Procedural Terminology codes to identify patients undergoing open repair or FEVAR. A previously developed and validated risk scoring system was revalidated using open and FEVAR patients. It was used to assign CAAA patients into risk strata, and outcomes of open and FEVAR repair were analyzed by patient risk.

Results: This study included 294 open and 165 FEVAR repairs. FEVAR patients were older (76 ± 9 vs 71 ± 9 years; $P < .01$), had peripheral vascular disease (18% vs 7% ± 9%; $P = .03$), and did not have rupture (0% vs 19%; $P < .01$). FEVAR had shorter operating room time (200 ± 130 vs 270 ± 130 minutes; $P < .01$) and median length of stay (3 vs 8 days; $P < .01$). FEVAR configurations involved 0 (71%), 1 (8%), 2 (2%), or 3 (19%) visceral stents. Our risk prediction model had excellent fit to open and

Table. Outcomes of open and fenestrated endovascular aneurysm repair (*FEVAR*) repair by risk strata

Risk strata	*Open, % (n = 107)*	*FEVAR, % (n = 80)*	P
Low risk			
Death	1	0	1
Complication			
Cardiac	3	1	1
Pulmonary	12	5	.2
Renal	5	2	.4
Moderate risk			
Death	7.5	8.7	.8
Complication			
Cardiac	6	4	.3
Pulmonary	22	3	<.01
Renal	8	3	.1
High risk			
Death	40	4	<.01
Complication			
Cardiac	17	4	.2
Pulmonary	33	12	.07
Renal	26	4	.02

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FEVAR patients (area under the curve = 0.87 for both groups). There were 39% (n = 177), 41% (n = 187), and 20% (n = 95) low-risk, intermediate-risk, and high-risk patients, respectively. The comparative outcomes of open vs FEVAR by risk strata are presented in the Table.

Conclusions: Favorable outcomes for FEVAR observed in high-risk patients likely reflect differences in clinical presentation; however, this analysis of early experience with FEVAR suggests comparable outcomes for open and FEVAR repair in low-risk and intermediate-risk patients.

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Table. Patency rates

Patients	*1-year primary patency, % (95% CI)*	*1-year primary assisted patency, % (95% CI)*	*1-year secondary patency, % (95% CI)*
All patients	90 (82-96)	94 (87-98)	95 (88-99)
Bypass			
AFB	88 (60-98)	94 (68-99)	100 (76-100)
Extra-anatomic	92 (81-97)	92 (81-97)	93 (83-98)
Endarterectomy	100 (40-100)	100 (40-100)	100 (40-100)
Other bypass	100 (52-100)	100 (52-100)	100 (52-100)

AFB, Aortobifemoral bypass; *CI*, confidence interval.

Aortoiliac Occlusive Disease: Role of Open Surgery in the Endovascular Era◇

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Objectives: Aortoiliac occlusive disease is a common manifestation of peripheral vascular disease. As reflected by the changes made in the Inter-Society Consensus for the Management of Peripheral Arterial Disease II guidelines, endovascular therapy is now the preferred modality for treatment in most patients. Some patients are not candidates for an endovascular approach due to their anatomy or prior interventions. Other patients may be better managed with open repair to preserve future endovascular options and allow access for contralateral infrainguinal interventions. This study investigated the indications for and outcomes of open operations for aortoiliac occlusive disease in a contemporary patient series.

Methods: Two affiliated hospitals' prospective databases were surveyed retrospectively. All patients who underwent an open operation for aortoiliac occlusive disease during a 5-year period from 2008 to 2012 were included in the analysis. Statistical analysis was performed using the Student *t*-test and Kaplan-Meier techniques.

Results: We identified 87 patients (69% male) who had open operations for aortoiliac occlusive disease. Mean follow up was 17.4 months. Average patient age was 64 years, and mean American Society of Anesthesiologists score was 3.1. Procedures included 16 aortobifemoral bypasses, 4 aortic endarterectomies, 61 extra-anatomic bypasses, 6 other bypasses, and 9 involved a combined endovascular procedure. The primary indications for surgery were chronic occlusive disease in 79 patients (22 rest pain, 18 tissue loss, 39 claudication) and acute limb ischemia with threatened limb in eight patients. The main indication for open operation in (84%) of patients was extent of disease. Twenty-one percent underwent unsuccessful attempts at endovascular treatment before open repair. Previous interventions were common: 22% had prior failed bypass and 38% had prior failed endovascular intervention. Patency rates at 1 year were as noted in the Table. The complication rate was 43%, and most were wound related. Major amputation rate was 8%, and perioperative mortality was 3.4% (n = 3).

Conclusions: In the setting of the current "endovascular first" paradigm, open surgery for aortoiliac occlusive disease remains an important revascularization option, especially for patients with diffuse disease. Short-term patency rates remain excellent, even in these patients who were either not candidates for or failed endovascular treatment. Future vascular trainees will continue to need these options in their armamentarium.

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Factors Impacting Cost in Elective Endovascular and Open Abdominal Aortic Aneurysm Repairs at Two Centers†

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Objectives: Cost data from two academic medical centers were examined to determine patient characteristics and/or clinical events that are predictive of high cost hospitalizations after elective endovascular (EVAR) and open (OAAA) abdominal aortic aneurysm repair. Elements of patient selection, operative performance, and postoperative complications were examined for their influence on cost.

Table. Cost data from two academic medical centers

EVAR patient				*OAAA patient*			
Center A factors	P	*Center B factors*	P	*Center A*	P	*Center B*	P
Iliac aneurysm	.01	Transferred	.01	Red EF	.04	CHF	.03
CABG/PTCA <5 years	.04	AAA diameter	.04	COPD − meds	.02	β-Blockers (protective)	.04
Reduced EF	.04			Prior bypass	.01	COPD-all	.01
Elevated creat	.02			Transfer	.048		
				Age	.002		
EVAR procedural				*OAAA procedural*			
Cover Int Iliac	.006	Graft vendor	.007	Anesthesia	.05	Exposure	<.0001
Other art proc	.002	OR coiling	.03	Exposure	.002	EBL	.03
EBL	<.0001	Unplanned ext	.01	Clamp position	.0001	IVF	.0004
IVF	<.0001	Art inj reg ext	.01	EBL	.004	Proc time	<.0001
Proc time	<.0001	EBL	.0007	IVF	.0003		
		IVF	.002	Proc time	.0004		
		Proc time	.0001				
Dysrhythmia	.01	Return OR	.01	Dysrhythmia	<.0001	Dysrhythmia	<.0001
Resp comp	.02	ICU stay	.049	Resp comp	<.0001	Resp comp	<.0001
Renal failure	.04			Renal failure	.008	Renal failure	.0005

AAA, Abdominal aortic aneurysm; *CABG*, coronary artery bypass grafting; *COPD*, chronic obstructive pulmonary disease; *EBL*, estimated blood loss; *EF*, ejection fraction; *EVAR*, endovascular aneurysm repair; *ICU*, intensive care unit; *OAAA*, open abdominal aortic aneurysm repair; *OR*, operating room; *PTCA*, percutaneous transluminal angioplasty.

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